

The Importance of Hittite and the Other Anatolian Daughter Languages for the Reconstruction of the Proto-Indo-European Phonological System

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The paper explores the important, though generally ignored, role that Hittite and the other older Anatolian daughter languages have to play in the reconstruction of the Proto-Indo-European phonological system.

INTRODUCTION

Before the discovery of Hittite and the other Anatolian Indo-European daughter languages, the consonant system of Sanskrit, with its four-way contrast of (1) plain voiceless ~ (2) voiceless aspirated ~ (3) plain voiced ~ (4) voiced aspirated stops and affricates, was thought to preserve the consonant system of the Indo-European parent language better than any of the other older Indo-European daughter languages:

	(1)	(2)	(3)	(4)
Velar	k	kh	g	gh
Palatal (affricates)	c	ch	j	jh
Retroflex	ṭ	ṭh	ḍ	ḍh
Dental	t	th	d	dh
Bilabial	p	ph	b	bh

Indeed, the prestige of Sanskrit is such that it has served as the model for the reconstruction of the Proto-Indo-European consonant system from the time of Schleicher to the present day. Most of the current handbooks/comparative grammars reconstruct a modified version of the Sanskrit consonant system for Proto-Indo-European,

eliminating, notably, the voiceless aspirates as well as the palatal and retroflex sounds of Sanskrit, while adding labiovelars, thus (cf. Clackson 2007:34; Fortson 2010:56; Mallory—Adams 2006:55):

	Labial	Dental	Palatal	Velar	Labiovelar
Voiceless	*p	*t	*k	*k	*k ^w
Voiced	(*b)	*d	*ǵ	*g	*g ^w
Voiced aspirated	*bh	*dh	*ǵh	*gh	*g ^w h

There are well-known and often-mentioned problems with this reconstruction (cf. Mallory—Adams 2006:50—53), especially the typological implausibility of such a system. Since I have discussed these problems in a previous paper (Bomhard 2016), I will not go into details here. Suffice it to say that the traditional reconstruction of the Proto-Indo-European system of stops, as represented above, is in desperate need of a major overhaul.

One of the most important axioms of the comparative method is that the oldest attested (and highest quality) data should play a pivotal role in the reconstruction of proto-languages. In the case of Indo-European, the oldest attested data come from the Anatolian branch, the consensus now being that this branch was the first to split off from the rest of the Indo-European speech community (cf. Jasanoff 2017:233—234). As it happens, the Anatolian branch contains several archaic features in the phonological systems of its member languages (namely, Cuneiform and Hieroglyphic Luwian, Hittite, Palaic, Lycian, Lydian, and several other poorly-attested languages), such as the preservation of laryngeals, not found in any of the other Indo-European daughter languages (cf. Jasanoff 2017: 221—225) — a trace of an earlier laryngeal most likely exists in Armenian (cf. Winter 1965), while Kümmel (2018) tries to show that laryngeals may have been preserved in Iranian as well. In my opinion, the significance of the Anatolian phonological data, except for the laryngeals, has not been fully appreciated.

From the very start, it must be made clear that there are still many unresolved questions regarding Hittite/Anatolian phonology. First, there is often disagreement among specialists concerning the interpretation of different writing conventions (cf. Jäntti 2017), though it is now generally accepted that “Sturtevant’s Law”, that is, medial double writing versus medial single writing of stops, represents a genuine phonemic distinction in Hittite (cf. Kimball

1999:90—95), either a voicing contrast or a fortis ~ lenis contrast or even something else altogether — Kloekhorst (2016:213—217) and Jäntti (2017), for example, consider the distinction between medial single writing versus medial double writing of stops in Hittite to be one of length, while Melchert (1994) and Yates (2019) maintain that medial double writing indicates simple gemination of earlier voiceless obstruents. Specifically, Yates (2019) maintains that:

... Sturtevant's Law was a conditioned pre-Hittite sound change whereby (i) contrastively voiceless word-medial obstruents regularly underwent gemination (cf. Melchert 1994), but gemination was blocked for stops in pre-stop position; and (ii) the inherited [\pm voice] contrast was then lost, replaced by the [\pm long] opposition observed in Hittite (cf. Blevins 2004). I provide empirical and typological support for this novel restriction, which is shown not only to account straightforwardly for data that is problematic under previous analyses, but also to be phonetically motivated, a natural consequence of the poorly cued durational contrast between voiceless and voiced stops in pre-stop environments. I develop an optimality-theoretic analysis of this gemination pattern in pre-Hittite, and discuss how this grammar gave rise to synchronic Hittite via "transphonologization" (Hyman 1976, 2013). Finally, it is argued that this analysis supports deriving the Hittite stop system from the Proto-Indo-European system as traditionally reconstructed with an opposition between voiceless, voiced, and breathy voiced stops (contra Kloekhorst 2016, Jäntti 2017).

Though the recent paper by Simon (2019) is directed specifically against the views of Kloekhorst and Jäntti, his conclusions apply equally to the views advanced by Yates. It is thus worth quoting Simon's concluding remarks in full:

Kloekhorst's arguments against the traditional voiced/voiceless contrast in Anatolian stops is not probative. None of his arguments necessarily require a contrast in length. Moreover, transcriptions and loanwords from half a dozen languages equivocally and unambiguously show that Hittite and Luwian stops were always perceived as voiceless and voiced stops and

never as geminates, *pace* Melchert and Kloekhorst. One cannot reject this evidence since the perception was consistent across many languages and many centuries (almost one millennium) involving both Hittite and Luwian. In other words, there is no reason to assume that the contrast in Anatolian stops was in length; and consequently the contrast in voice is neither a shared innovation nor a defining feature of the non-Anatolian Indo-European languages.

Next, there is still no consensus on the significance of plene writing of vowels (cf. Makarova 2001). These unresolved questions notwithstanding, the Anatolian data can still tell us a great deal about the phonological system of their immediate Proto-Indo-European ancestor. As we shall see, it is nothing at all like the Sanskrit-based reconstruction mentioned above.

Let us now look first at the laryngeals, then at the stops, and finally at the vowels.

LARYNGEALS

The literature dealing with the laryngeals is extensive, and several competing versions of the “Laryngeal Theory” have been proposed — the majority of scholars posit three laryngeals (cf. Jasanoff 2017:223), which may be written **H₁*, **H₂*, **H₃*, to which a minority of scholars add yet another, **H₄*. Labialized and palatalized laryngeals have also been proposed. It is beyond the scope of this paper to discuss, in detail, the history of the Laryngeal Theory or to evaluate the competing proposals. For more information, see Bammesberger 1984; Benveniste 1935; Keiler 1970; Kellens (ed.) 1990; Kümmel 2018; Laroche 1986; Lindeman 1970, 1987, 1997; Sturtevant 1942; Winter (ed.) 1965.

All of the older Anatolian daughter languages (Hittite, Palaic, and Cuneiform and Hieroglyphic Luwian) contain signs that are transliterated as *h*-, *-h(h)*- or *h*-, *-h(h)*-. In 1927, Jerzy Kuryłowicz and Albert Cuny independently identified Hittite *h*-, *-h(h)*- with de Saussure’s famous *coefficients sonantiques*. These sounds have subsequently been called “laryngeals”, though it should be noted that this term refers to these sounds as a class rather than saying anything about their phonetic make-up.

In his 1935 monograph entitled *Études indoeuropéennes I*, Kuryłowicz set up four laryngeals, which he wrote **ǵ₁*, **ǵ₂*, **ǵ₃*, **ǵ₄*

(cf. Kurylowicz 1935:27—76). According to Kurylowicz, $*\varrho_2$ and $*\varrho_3$ were preserved in Hittite, while $*\varrho_1$ and $*\varrho_4$ were lost. Specifically, Kurylowicz set up $*\varrho_1$ ($= *H_1$) to account for instances of Proto-Indo-European $*e$ without a corresponding Hittite laryngeal reflex, $*\varrho_2$ ($= *H_2$) to account for instances of Proto-Indo-European $*a$ with a corresponding Hittite laryngeal reflex, $*\varrho_3$ ($= *H_3$) to account for instances of Proto-Indo-European $*o$ with a corresponding Hittite laryngeal reflex, and $*\varrho_4$ ($= *H_4$) to account for instances of Proto-Indo-European $*a$ without a corresponding Hittite laryngeal reflex. It should be noted that, while Kurylowicz assumes that $*\varrho_3$ changed a contiguous $*e$ to $*o$, Sturtevant (1938:104—111, 1942:20, and 1951:49—51) assumes that this laryngeal did not color contiguous vowels.

In my opinion, the system of four laryngeals set up by Kurylowicz is the most straightforward and economical way to account for all of the developments of the laryngeals in the Indo-European daughter languages (cf. Bomhard 2004). The alternative, three-laryngeal approach, which essentially dispenses with $*H_4$, puts its proponents in the awkward position of having to explain how the single remaining a -coloring laryngeal, namely, $*H_2$, was alternatively either lost or preserved in identical environments in Hittite, without any apparent conditioning factors.

STOPS

It is clear that Proto-Anatolian had a voicing contrast in stops in all positions, initial, medial, and final (cf. Kimball 2017:252—253; Melchert 2017:177; Luraghi 1998:175), though this may have developed into a fortis ~ lenis contrast independently in the various Anatolian daughter languages. From the point of view of the Proto-Indo-European ancestor of Proto-Anatolian, it is the preservation of a voicing contrast that is of paramount importance and not the inner-Anatolian developments. Thus, at a minimum, the following stops can be confidently reconstructed for Proto-Anatolian:

	Voiceless	Voiced
Bilabial	p	b
Dental	t	d
Velar	k	g
Labiovelar	k ^w	g ^w

Now, it should be noted that there is absolutely no evidence whatsoever from any of the Anatolian daughter languages that a series of voiced aspirates existed in Proto-Anatolian (cf. Kimball 2017:252). This is an important point. It implies that the voiced aspirates traditionally reconstructed for Proto-Indo-European must have developed after the separation of the Anatolian branch from the main speech community. In fact, the voiced aspirates are only really needed to account for developments in Indo-Aryan (but not Iranian), Greek, Armenian, and Italic. They may also be needed to explain certain developments in Celtic, Germanic, and Tocharian.

As noted above, the traditional reconstruction of the Proto-Indo-European stop system posits a three-way contrast of (1) plain voiceless stops, (2) plain voiced stops, and (3) voiced aspirated stops. While the voiceless stops posited for Proto-Anatolian above unambiguously correspond to the plain voiceless stops (*p, *t, *k, *k^w) of traditional Proto-Indo-European, the voiced stops posited for Proto-Anatolian above are usually taken to correspond to both the plain voiced stops (*b, *d, *g, *g^w) and the voiced aspirated stops (*b^h, *d^h, *g^h, *g^{wh}) of traditional Proto-Indo-European. This is interpreted to mean that the plain voiced stops and voiced aspirates of traditional Proto-Indo-European have merged into a single series of plain voiced stops in Proto-Anatolian (cf., for example, Kloekhorst 2008:17). Though on the surface, this appears to account quite nicely for the Anatolian developments, there are indications from within Anatolian itself that a three-way contrast must be reconstructed in the system of stops for Proto-Anatolian instead of a simple two-way contrast. The evidence, though sparse, comes mainly from Luwian and, to a lesser extent, Hittite.

In Luwian, traditional Proto-Indo-European *k was preserved before high front vowels, as in the following example:

Cuneiform Luwian *kiš-* ‘to comb, to card’ = Hittite (3rd sg. pres. act.) *ki-iš-zi* ‘to comb’ < Proto-Anatolian **kes-* ‘to comb, to card’ < traditional pre-Anatolian Proto-Indo-European **kes-* ‘to comb, to card’. Probable non-Anatolian cognates include Greek κέσκεον (< **kes-kes-*) ‘tow, oakum’; Old Church Slavic *češq*, *česati* ‘to comb, to pull off’.

On the other hand, traditional Proto-Indo-European *ǵh was lost in the same environment in Luwian, as shown by the following examples:

1. Cuneiform Luwian (nom. sg.) *(i-)iš-ša-ri-iš*, *i-iš-ri-iš*, etc. ‘hand’; Hieroglyphic Luwian (acc. sg.) *i-sà-tara/i-na* ‘hand’; Lycian *izri-* ‘hand’ (all with loss of an earlier initial voiced velar before high front vowel) = Hittite (nom.-acc. sg.) *ki-eš-šar* ‘hand’ < Proto-Anatolian **gēsar* ‘hand’ < traditional pre-Anatolian Proto-Indo-European **ǵhēsṛ* ‘hand’. Non-Anatolian cognates (from the same root but with a different suffix) include the following: Sanskrit *hásta-h* ‘hand’; Old Persian *dasta-* ‘hand’; Avestan *zasta-* ‘hand’; Latin *praestō* (< **prae-hestōd*) ‘at hand, ready’. Note: The Hieroglyphic Luwian form contains an epenthetic *t*.
2. Cuneiform Luwian (gen. sg.) *im-ma-ra-aš-ša* ‘open country’ = Hittite (nom. sg.) *gi-im-ra-aš* ‘the outdoors, countryside, field; military campaign’ < Proto-Anatolian **gim-ra-* ‘open country, countryside, field’ < traditional pre-Anatolian Proto-Indo-European **ǵhim-ro-* ‘open country, countryside’ (< ‘the wintry steppe, the inhospitable outdoors’ [cf. Kloekhorst 2008:476—477; but see Garnier 2018 for a different interpretation]). Non-Anatolian cognates include Greek *χειμερινός* ‘of or in winter; stormy’; Armenian *jmeṛn* ‘winter, snow-storm’.

Now, what about traditional *ǵ. Curiously, it appears to have been preserved before high front vowels in Luwian, provided, of course, that the following is a valid etymology:

Cuneiform Luwian ([adj.] gen.) *ki-in-za-al-pa-aš-ši-iš* ‘kind, gentle (?)’ = Hittite (2nd sg. present act.) *ge-en-zu-wa-i-ši* ‘to treat gently, to be compassionate (towards), to be kind’, ([adj.] nom. sg.) *ge-en-zu-wa-la-aš*, *gi-in-zu-wa-la-aš* ‘kindhearted, gentle’ < Proto-Anatolian **gen-s-* ‘to treat gently, to be kind’ < traditional pre-Anatolian Proto-Indo-European **ǵenH₁-(s-)* ‘to treat gently, to be kind’. Non-Anatolian cognates include Latin *gentilis* ‘belonging to one’s family, clan, tribe, or nationality’ (> Modern English *gentle* in the sense ‘considerate or kindly in disposition; amiable and tender’); Old English *gecynd* ‘nature,

quality, character; race, species; origin, generation, birth’, *gecynde* ‘natural, native, innate; proper, fitting, lawful’, *gecyndelic* ‘kindly; natural, innate; proper’. Note: The meaning of the Cuneiform Luwian form is uncertain. The interpretation given here is that of the author, based upon the putative Hittite cognate.

Thus, we can clearly see that the three series have different treatments before high front vowels in Luwian. Traditional pre-Anatolian Proto-Indo-European **k* and **ǵ* were preserved, while **ǵh* was lost. If, as is often claimed, the traditional pre-Anatolian Proto-Indo-European plain voiced stops and voiced aspirates had merged in Proto-Anatolian, we would expect **ǵ* to have been lost before high front vowels in Luwian as well, which does not appear to be the case.

More evidence is to be found in the treatment of dentals initially before high front vowels and *y* in Hittite. In this case, the voiceless dental stop (**t*) of traditional Proto-Indo-European became an affricate *z* (= *ts*) in Hittite (cf. Sturtevant 1951:60—61; Melchert 1994:117; Kimball 1999:287—288), while the voiced aspirated dental stop (**dh*) of traditional Proto-Indo-European was preserved (cf. Kimball 1999:292), as in (3 sg. pres. act. ?) *ti-it-ta-i* ‘to install, to assign’ < **dhi-dhH₁-oi-ei* (cf. Kloekhorst 2008:881—882 — other reconstructions are possible). The traditional plain voiced dental stop (**d*), on the other hand, became *š* in Hittite (cf. Kimball 1999:291—292) (but not in Cuneiform and Hieroglyphic Luwian or Palaic), as shown in the following example:

Hittite (nom. sg.) *ši-i-wa-az* ‘day’ and (gen. sg.) *ši-(i-)ú-na-aš* ‘god’ = Palaic (nom. sg.) *Ti-ya-az(-)* name of the sun-god, (nom. sg.) *ti-ú-na-aš* ‘god’; Hieroglyphic Luwian *Tiwat-* name of the sun-god, (adj.) *tiwatami-* ‘bright, sunny’; Cuneiform Luwian (nom. sg.) *Ti-wa-az* name of the sun-god < Proto-Anatolian **tyēwat-* < pre-Anatolian Proto-Indo-European **dyēw-* (cf. Benveniste 1962:8; Kloekhorst 2008:763—764). Non-Anatolian cognates include: Sanskrit *dyáu-h* ‘heaven, sky, day’, *devá-h* ‘god’; Greek Ζεύς ‘Zeus’, δῖος ‘god-like, divine’; Armenian *tiv* ‘day’; Latin *diēs* ‘day’, *deus* ‘god’; etc.

Here once again, had the traditional pre-Anatolian Proto-Indo-European plain voiced stops and voiced aspirates merged in Proto-

Anatolian, we would expect **d* and **dh* to have the same treatment before high front vowels and *y* in Hittite, which is not the case.

Though the cumulative evidence from the Anatolian daughter languages, such as it is, points to three series of stops in Proto-Anatolian instead of two, we run into a potential problem, if, as stated above, there is no evidence for earlier voiced aspirated stops in either Proto-Anatolian or pre-Anatolian Proto-Indo-European. It is wrong, lacking corroborating evidence, to project the Sanskrit-based reconstruction of the Proto-Indo-European consonant system back in time to pre-Anatolian Proto-Indo-European. In other words, the Anatolian evidence should be taken at face-value. Consequently, given that pre-Anatolian Proto-Indo-European most likely did not have voiced aspirated stops as part of its consonant inventory, then a solution to this problem is really not possible within the context of the traditional reconstruction of the Proto-Indo-European consonant system. However, a viable solution was proposed in three articles by Gamkrelidze. Essentially, based upon a careful examination and analysis of Hittite scribal conventions, Gamkrelidze proposed a radical new interpretation of Sturtevant's Law. This new interpretation has major implications not only for Proto-Anatolian but also for pre-Anatolian Proto-Indo-European.

In the first article, Gamkrelidze (1968:91—92) maintains that Hittite was written in a cuneiform syllabary derived from a form of Old Akkadian cuneiform in use in Northern Syria in the beginning of the second millennium BCE. Now, the older cuneiform writing system, which was developed by the Sumerians, was not suited to rendering Akkadian, much less Hittite. In Old Akkadian, voiceless, voiced, and emphatic consonants were not differentiated in the writing system, though methods were gradually developed to represent most of the Akkadian phonological distinctions. This is important, for no attempt was ever made, even after Akkadian had introduced separate syllabograms to differentiate voiceless, voiced, and emphatic consonants, to modify the Hittite writing practices to make use of the same methods to note a voicing contrast in stops (cf. Melchert 2017:177; Kloekhorst 2008:21 and 2016:214—215). We must conclude, therefore, that the Hittite scribes did not feel that it was worthy of noting such a contrast, regardless of what the underlying phonetics may have been.

What then, if anything, does medial double writing of stops indicate if not a voicing contrast? According to Gamkrelidze

(1968:94), medial double writing of stops in Hittite was used as a means to indicate the presence of aspiration (Patri 2009 and 2019 reaches the same conclusion). In the two subsequent articles (1982 and 2008), Gamkrelidze elaborates further on this proposal.

But, there is more. There are several troubling exceptions to Sturtevant's Law in which words exhibiting medial double writing of stops in Hittite correspond etymologically to words in other Indo-European daughter languages with medial voiced stops. These alleged exceptions can best be explained as geminates (cf. Bomhard 2000 for discussion and examples).

Taking into consideration Gamkrelidze's findings as well as the apparent exceptions, Sturtevant's Law is to be reinterpreted as follows: double writing of medial stops indicates stop plus something additional, that is, either aspiration or gemination, while single writing of medial stops indicates a plain stop pure and simple. It does not indicate either a voicing contrast or a fortis ~ lenis contrast as traditionally assumed.

There is another, very important implication of Gamkrelidze's theories. As stated at the beginning of this section, "there is absolutely no evidence whatsoever from any of the Anatolian daughter languages that a series of voiced aspirates existed in Proto-Anatolian". Since it was clearly the feature of aspiration that was important to the Hittite scribes, this means that, had there been a series of voiced aspirates in Hittite, we would expect that they, too, would have been written double medially. However, this is not the case. The sounds in question (series 3 below) are consistently written single medially — no aspiration, no double writing; hence, no voiced aspirates.

Given that three series of stops must be reconstructed for Proto-Anatolian, we can now add a third series to its consonant inventory on the basis of the new interpretation of Sturtevant's Law by Gamkrelidze, namely, voiceless aspirates, thus:

	(1) Voiceless Aspirated	(2) Plain Voiceless	(3) Plain Voiced
Bilabial	p ^h	p	b
Dental	t ^h	t	d
Velar	k ^h	k	g
Labiovelar	k ^{wh}	k ^w	g ^w

The voiceless aspirated stops (column 1) correspond to the plain voiceless stops (*p, *t, *k', *k, *k^w) of traditional Proto-Indo-European, while the plain voiceless stops (column 2) correspond to the plain voiced stops (*b, *d, *g', *g, *g^w), and the plain voiced stops (column 3) correspond to the voiced aspirated stops (*b^h, *d^h, *g'^h, *g^h, *g^{wh}).

On the surface, it would appear that a sound-shift similar to what is assumed to have taken place in early Proto-Germanic — so-called “Grimm’s Law” (cf. Fulk 2018:102—105) — is to be set up to account for the development of the above Proto-Anatolian consonant system from traditional Proto-Indo-European. But is this really warranted? No — not if the glottalic model of Proto-Indo-European consonantism (on which, see Bomhard 2016 and 2018.I: 55—65; Gamkrelidze 1987 and 2003; Gamkrelidze—Ivanov 1972, 1973, and 1995.I:5—16; Hopper 1973, 1977a, 1977b, 1981, and 1982; Salmons 1993) is taken as the starting point. Then, all that is needed is the deglottalization of the glottalics to arrive at the Proto-Anatolian consonant system proposed above (so also Kloekhorst 2008:25, but see below). Such a change would eliminate the need to assume a sound-shift. Thus, under the glottalic model of Proto-Indo-European consonantism (specifically, as formulated by Bomhard 2016), the voiceless aspirated stops (column 1) correspond to voiceless aspirated stops (*p^h, *t^h, *k'^h, *k^h, *k^{wh}) in the glottalic model, while the plain voiceless stops (column 2) correspond to glottalized stops (*p', *t', *k', *k', *k'^w), and the plain voiced stops (column 3) correspond to plain voiced stops (*b, *d, *g', *g, *g^w). Viewed in this light, the Proto-Anatolian stop system reconstructed above provides strong support for the glottalic model of Proto-Indo-European consonantism as opposed to the traditional reconstruction. Furthermore, it eliminates the need to posit a series of voiced aspirates in its immediate Proto-Indo-European ancestor. Finally, it should be noted that this new interpretation is completely natural from a typological perspective, thus overcoming the problem of the typological implausibility of the traditional reconstruction of the Proto-Indo-European stop system.

At this point, it is necessary to discuss a new theory proposed by Kloekhorst, which affects the reconstruction of series 2 above. In a 2014 paper (unpublished), Kloekhorst argues that Luwian provides evidence for the preservation of glottalization, explicitly,

pre-glottalization, in series 2 above. He presents more evidence in his 2016 article (Kloekhorst 2016:226—228), concluding:

All in all, my reconstruction of the pre-Proto-Anatolian stop system is one of three series, namely one of voiceless long stops, one of pre-glottalized voiceless short stops, and one of plain voiceless short stops, corresponding to the PIE stops in the way shown in Tab. 2 (exemplified by the row of dental stops).

Thus, for pre-Proto-Anatolian, Kloekhorst reconstructs */t:/, */ʔt/, */t/ (= traditional Proto-Indo-European *t, *d, *dh, respectively), using the dentals for illustration (however, Simon 2019 presents compelling evidence against Kloekhorst’s interpretation — see above for details).

Now, the cumulative evidence from all of the Indo-European daughter languages seems to indicate that the glottalized stops (that is, *pʰ, *tʰ, *kʰ, *kʰ, *kʰʷ) were originally post-glottalized in all positions in Proto-Indo-European, including pre-Anatolian Proto-Indo-European. In my 2016 paper entitled “The Glottalic Model of Proto-Indo-European Consonantism: Re-igniting the Dialog”, I proposed that there may have been dialectal variation in the timing of glottalization in the glottalic series before their ultimate loss, and I cited the example of the American Indian language S̓malgyax (also called Coast Tsimshian) spoken in northwestern British Columbia and southeastern Alaska as a possible typological parallel (Bomhard 2016:387). The following rules for the timing of glottalization may tentatively be postulated for at least some dialects of Proto-Indo-European:

1. If a glottalized segment occurs before a vowel, it is post-glottalized: /Ċ/ → [Cʰ]/__V.
2. If a glottalized segment occurs after a vowel, it is pre-glottalized: /Ċ/ → [ʔC]/V__.
3. If a glottalized segment occurs word final before pause, it is deglottalized and unreleased: /Ċ/ → [C̚]/__#.
4. If a glottalized segment occurs between vowels, it is post-glottalized if the accent falls on the second vowel: /Ċ/ → [Cʰ]/V__V̌.
5. If a glottalized segment occurs between vowels, it is pre-glottalized if the accent falls on the first vowel: /Ċ/ → [ʔC]/V̌__V.

Notes:

1. /Ċ/ = any glottalic (/p'/, /t'/, /k'/, /k'^w/).
2. Rule no. 2 would account for Winter's Law in Balto-Slavic (a typological parallel may exist in Nuxalk [Bella Coola] [cf. Beltzung 2008:52—56]).
3. Rule no. 2 would account for the “vestjysk stød” in the western dialects of Danish and preaspiration in West Scandinavian, if these are not recent developments, as some have maintained.

Setting up the above rules would account for Kloekhorst's views on pre-glottalization. It should also be noted that such a scenario is hinted at by Salmons (1993:24) but not elaborated upon.

Thus, incorporating Kloekhorst's views, the Proto-Anatolian system of stops may now be fully reconstructed as follows:

	Voiceless Aspirated	Glottalized	Plain Voiced
Bilabial	p ^h	p'	b
Dental	t ^h	t'	d
Velar	k ^h	k'	g
Labiovelar	k ^{wh}	k' ^w	g ^w

Note: The velar series may be assumed to have had non-phonemic palatalized allophones in certain environments (cf. Bomhard 2018.I:85—86). These allophones became phonemic in Luwian (cf. Melchert 2017:176) as well as in several of the non-Anatolian Indo-European daughter languages — the so-called “satəm” languages.

At the beginning of this paper, I stated: “[i]n my opinion, the significance of the Anatolian phonological data, except for the laryngeals, has not been fully appreciated.” We have now come full circle. Taking fully into consideration the Anatolian evidence, we can confidently abandon the traditional reconstruction of Proto-Indo-European consonantism, both for pre-Anatolian and post-Anatolian Proto-Indo-European, and substitute a system identical to that reconstructed above for Proto-Anatolian. For details on the development of this revised Proto-Indo-European consonant system in the non-Anatolian Indo-European daughter languages, cf. Bomhard 2016 and, especially, 2018.I:115—158 (Chapter 5).

VOWELS

In this section, we will not be concerned with allophones of the vowels, nor will we be concerned with diphthongs or accentuation (on which, cf. Kimball 2017:255). Rather, the primary focus will be on what the Anatolian vowels can tell us about the vowels in pre-Anatolian Proto-Indo-European.

According to Kimball (2017:249—251), the following vowels are to be reconstructed for Proto-Anatolian (see also Melchert 2017:176; Kloekhorst 2008:17 — Kloekhorst does not reconstruct Proto-Anatolian */æ/):

i, ī		u, ū
e, ē		o, ō
æ	a, ā	

Kimball notes that */æ/ developed from earlier **eH*₁. Kimball does not provide justification for reconstructing **o*, **ō* for Proto-Anatolian. However, Melchert (1992:186, 1994:291—294, and 2017:176) justifies the reconstruction of Proto-Anatolian **o*, **ō* on the basis of developments in Lycian. Melchert claims that Lycian /*e*/ comes, in part, from earlier */*o*/ and provides several examples. In my opinion, we are dealing with specific Lycian developments here, inasmuch as there is absolutely no evidence from Cuneiform and Hieroglyphic Luwian for *o* distinct from *a* (see below) — the much later Lycian belongs to the Luwian branch of Anatolian.

Melchert (1992:183) notes that Hittite had four short vowels: /*u*/, /*a*/, /*i*/, and /*e*/ and that /*i*/ and /*e*/ were distinct vowels during all periods of Hittite. Hittite also had the following long vowels: /*ū*/, /*ā*/, /*ī*/, and /*ē*/ (cf. Kimball 1999:45; Kloekhorst 2008:33—34; Melchert 1992:188). The same set of short and long vowels is also assumed to have existed in Palaic (cf. Melchert 1994:198—204), though the phonemic status of /*e*/ is controversial. Cuneiform and Hieroglyphic Luwian, on the other hand, have only the short vowels /*u*/, /*a*/, and /*i*/ and the long vowels /*ū*/, /*ā*/, and /*ī*/ (cf. Melchert 1994:239—245 and 2003:177, 179).

Proto-Indo-European is considered to have had both apophonic **o* and non-apophonic (original) **o* (cf. Bomhard 2018.1:88—99). Significantly, the **e* ~ **o* qualitative apophony (Ablaut) of traditional Proto-Indo-European appears as /*e*/ ~ /*a*/ in Hittite (cf. Luraghi 1998:175) — neither Cuneiform nor Hieroglyphic Luwian

provide much help here, inasmuch as earlier **e*, **o*, and **a* are all reflected as /a/ in these languages. Though the Hittite patterning is usually interpreted to mean that apophonic **o* became /a/ in Hittite, it is equally possible that the apophonic **o* of traditional Proto-Indo-European came from earlier **a* and that Hittite reflects the earlier, pre-Anatolian Proto-Indo-European apophonic patterning.

Leaving aside the **/æ/* reconstructed for Proto-Anatolian above by Kimball, which is clearly a specific Anatolian development, reinterpreting the **e ~ *o* qualitative Ablaut of traditional Proto-Indo-European as an **e ~ *a* Ablaut, and, finally, adding **ə*, the so-called “schwa secundum” of traditional Proto-Indo-European (this is usually written **b* or subscript **_e*), I would reconstruct the following vowel inventory for pre-Anatolian Proto-Indo-European (cf. Bomhard 2018.I:110—111):

e	o	a	i	u	ə
ē	ō	ā	ī	ū	

Notes:

1. In pre-Anatolian Proto-Indo-European, the vowel **e* was lowered and colored to **a* when contiguous with so-called “*a*-coloring” laryngeals (**H₂* and **H₄*).
2. Apophonic **o* had not yet developed in pre-Anatolian Proto-Indo-European. It arose later in post-Anatolian Proto-Indo-European from apophonic **a*. However, already during this stage, and even earlier, there was a non-apophonic **o* (cf. Kümmel 2012:306—320).

CONCLUDING REMARKS

We have now come to the end of our study. I intentionally did not discuss all of the issues regarding Anatolian phonology — the standard handbooks given in the references should be consulted for more information regarding inner-Anatolian developments. I also did not discuss the glides or the nasals and liquids. Rather, to repeat, I have explored the important, though generally ignored, role that Hittite and the other older Anatolian daughter languages have to play in the reconstruction of the (pre-Anatolian) Proto-Indo-European phonological system, concentrating on the system of stops and the vowels. The laryngeals were only treated

superficially, since they have been discussed rather thoroughly by numerous other scholars, and I have nothing new to add to the discussion beyond what I have already written (Bomhard 2004).

In this study, I have tried to show that the phonological system reconstructed for Proto-Anatolian can better be explained on the basis the glottalic model of Proto-Indo-European consonantism rather than the traditional, Sanskrit-based reconstruction. Thus, on the basis of this study, I would reconstruct the pre-Anatolian Proto-Indo-European phonological system as follows (column 1 is voiceless aspirated, column 2 is glottalized, and column 3 is plain voiced):

	(1)	(2)	(3)	
Obstruents	p ^h	p'	b	(bilabial)
	t ^h	t'	d	(dental)
	k ^h	k'	g	(velar)
	k ^{wh}	k' ^w	g ^w	(labiovelar)
	s			

Laryngeals	H ₁	H ₂	H ₃	H ₄
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Nasals and Liquids	m/ <u>m̥</u>	n/ <u>n̥</u>	l/ <u>l̥</u>	r/ <u>r̥</u>
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Glides	w(/u)	y(/i)
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Vowels	e	o	a	i	u	ə
	ē	ō	ā	ī	ū	

At this point, it may be noted that Proto-Indo-European went through several distinct stages of development, and these stages are outlined in my 2018 book (Bomhard 2018.I:106—113) and, to a lesser extent, in my 2016 paper. The views expressed there expand upon and revise earlier work by Winfred P. Lehmann (1952:109—114). Astonishingly, these stages are generally ignored by scholars working within the framework of the traditional reconstruction of the Proto-Indo-European phonological system, where the monolithic, typologically-implausible, Sanskrit-based reconstruction of the Proto-Indo-European consonant system is mechanically projected back in time to try to explain the Anatolian developments. This stretches credibility beyond reasonable bounds. All

languages change over time, and there is absolutely no reason to assume that Proto-Indo-European was different in that regard.

For the latest period of development of the Indo-European parent language, the stage I call “Disintegrating Indo-European” — after the separation of the Anatolian branch from the rest of the Indo-European speech community and just before the emergence of the individual non-Anatolian Indo-European daughter languages —, I have suggested (Bomhard 2018.I:125) that the Proto-Indo-European antecedent of the satəm daughter languages is to be reconstructed as follows (column 1 is voiceless aspirated, column 2 is glottalized, and column 3 is voiced aspirated):

	(1)	(2)	(3)	
Obstruents	p ^h	pʼ	b ^h	(bilabial)
	t ^h	tʼ	d ^h	(dental)
	k ^{yh}	kʼy	g ^{yh}	(palatovelar)
	k ^h	kʼ	g ^h	(velar)
	k ^{wh}	kʼw	g ^{wh}	(labiovelar)
	s			

Laryngeals	h/h̥
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Resonants	m/m̥	n/n̥	l/l̥	r/r̥	w/u	y/i
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Vowels	e	o	a	(i)	(u)	ə
	ē	ō	ā	ī	ū	

The most significant difference between the phonological system of the Disintegrating Indo-European antecedent of the satəm dialects and that of the centum dialects was in the treatment of the gutturals. In the centum dialects, the labiovelars did not become delabialized, and the palatovelars remained subphonemic.

The phonological system of the Disintegrating Indo-European antecedent of the centum daughter languages, on the other hand, may be reconstructed as follows (column 1 is voiceless aspirated, column 2 is glottalized, and column 3 is voiced aspirated):

	(1)	(2)	(3)	
Obstruents	p ^h	p'	b ^h	(bilabial)
	t ^h	t'	d ^h	(dental)
	k ^h	k'	g ^h	(velar)
	k ^{wh}	k' ^w	g ^{wh}	(labiovelar)
	s			

Laryngeals	h/h̥
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Resonants	m/m̥	n/n̥	l/l̥	r/r̥	w/u	y/i
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Vowels	e	o	a	(i)	(u)	ə
	ē	ō	ā	ī	ū	

The following series of phonological changes may be assumed to have taken place in the Indo-European parent language after the separation of the Anatolian branch and before the emergence of the individual non-Anatolian Indo-European daughter languages:

1. The laryngeals $*H_1$ and $*H_4$ were lost initially before vowels, while $*H_2 > *h$ and $*H_3 > *\hat{h} > *h$ in the same environment.
2. Next, all medial and final laryngeals merged into $*h$.
3. The single remaining laryngeal $*h$ was then lost initially before vowels (except in Pre-Armenian) and medially between an immediately preceding vowel and a following non-syllabic. This latter change caused the compensatory lengthening of preceding short vowels, thus:

eHC	>	ēC
oHC	>	ōC
aHC	>	āC
iHC	>	īC
uHC	>	ūC

4. $*h$ was preserved in all other positions. $*h$ had a syllabic allophone, $*h̥$, when between two non-syllabics. This syllabic allophone is the traditional schwa primum ($*ə$).
5. Glottalization was probably lost in late Disintegrating Indo-European itself just as the individual non-Anatolian daughter languages were beginning to emerge.

6. The earlier plain voiced stops developed into voiced aspirates (column 3 above), at least in some dialects of Disintegrating Indo-European.
7. The $*e \sim *a$ qualitative Ablaut of pre-Anatolian Proto-Indo-European developed into an $*e \sim *o$ Ablaut.
8. New Ablaut relationships developed as a result of the loss of laryngeals.

APPENDIX: CORROBORATING EVIDENCE

As is well known, the glottalic model of Proto-Indo-European consonantism (the “Glottalic Theory”) has not escaped criticism. Though it generated strong interest in the scholarly community when it was first proposed, the Glottalic Theory is now mostly ignored, except among the Indo-European scholars working in Leiden, The Netherlands. It is usually only mentioned in passing in the standard handbooks. In 2016, I published a paper in *Slovo a slovesnost* in which I addressed all of the criticisms that have been lodged to date against the Glottalic Theory. Most of the criticisms were fairly easy to refute, though a minority were a bit more challenging. In the end, not a single criticism was able to withstand scrutiny — all were rejected.

The glottalic model of Proto-Indo-European consonantism was initially proposed to rectify the typological implausibility of the traditional, Sanskrit-based reconstruction, and it was based strictly on the analysis of Indo-European evidence, though typological data were used in conjunction with this analysis to demonstrate that the glottalic model presented a more natural reconstruction, with numerous parallels among attested languages.

Over the past three decades or so, especially after the collapse of the Soviet Union and the opening of new opportunities for archeologists, enormous progress has been made in substantiating the Kurgan Theory, propounded especially by the late Marija Gimbutas, according to which the homeland of the speakers of Proto-Indo-European was located on the European steppes to the north of and between the Black and Caspian Seas. So much progress has been made recently that all other theories regarding the Indo-European homeland have now been largely abandoned.

At the time the Glottalic Theory was proposed, corroborating evidence from neighboring or distantly-related languages was not brought into the picture, and such evidence has not figured prominently in discussions about Proto-Indo-European, except for some tantalizing hints in the work of Frederik Kortlandt. That gap has now been filled — on Friday, 10 July 2015, I presented a paper entitled “The Origins of Proto-Indo-European: The Caucasian Substrate Hypothesis” at a conference held at Leiden University, The Netherlands, named “The Precursors of Proto-Indo-European: The Indo-Hittite and Indo-Uralic Hypotheses”. The basic premise of this paper is that, around 5,000 BCE, pre-Indo-Europeans migrated southwestward from the area north of the Caspian and Aral Seas to the northeastern shores of the Black Sea, where they encountered and mingled with speakers of primordial Northwest Caucasian languages. The prolonged period of contact that took place between these two language groups gave rise to the form of Proto-Indo-European traditionally reconstructed in the standard handbooks. A modified and greatly expanded version of that paper recently appeared (2019) in the *Journal of Indo-European Studies*.

In that paper, among other things, I presented lexical evidence for language contact between Northwest Caucasian and Proto-Indo-European, proposing nearly 200 lexical parallels, arranged into semantic fields. These lexical parallels represent borrowings either from Proto-Indo-European into Northwest Caucasian or from Northwest Caucasian into Proto-Indo-European.

The most important finding from that paper, as it relates to the topics under discussion here, is that corroborating evidence providing strong support for the glottalic model of Proto-Indo-European consonantism has now been uncovered on the basis of prehistoric language contact between Proto-Indo-European and Northwest Caucasian.

The following sound correspondences can be provisionally established between Proto-Indo-European, Common Abkhaz, and Proto-Circassian (these sound correspondences are based upon the examples given in Bomhard 2019):

Indo-European	Common Abkhaz	Proto-Circassian
*p ^h	*p	*p ^h , *p:
*t ^h	*t, *c, *ć, *č, *č'	*t ^h , *t:, *c ^h , *c:, *č ^h , *č:, *č ^h ', *č:.'
*k ^h	*k, *k', *q	*k ^h , *k:, *q ^h , *q:
*k ^{wh}	*k ^o , *q ^o	*k ^{h0} , *k: ^o , *q ^{h0} , *q: ^o
*p ^h Vs-	*psV-	*PsV-
*p ^h VH ₂ -	*pǰV-	
*p'	*p'	*p'
*t'	*t', *c', *ć', *č', *č''	*t', *c', *č', *č''
*k'	*k', *k'', *q', *q''	*k', *q'
*k' ^w	*k' ^o , *q' ^o	*k' ^o , *q' ^o
*b ^h	*b	*b
*b ^h Vs-	*bzV-, bžV-	*PzV-
*d ^h	*d, *ǰ, *ǰ', *ž, *ž'	*d, *ǰ, *ž, *ž'
*g ^h	*g, *g', *γ, *γ'	*g, *ǧ, *γ
*g ^{wh}	*g ^o , *γ ^o	*g ^o , *ǧ ^o
*s	*s, *ś, *š, *š', *z, *ź, *ž, *ž'	*s, *ś, *š, *š ^h , *š ^h ', *š:, *š:', *z, *ž, *ž'
*H ₁ (= *ʔ)	*Ø	*Ø, *h
*H ₄ (= *h)	*Ø	*Ø
*H ₂ (= *ḥh) (< *ḥ)	*ḥ, *ḥ', *ḥ'	*ḥ, *x, *ḥ
*H ₃ (= *ḥḥ) (< *ḥ)	*ḥ (< *ḥḥ < *ḥ)	*ḥ (< *ḥ)
*w	*w	*w
*y	*j	*y
*m	*m	*m
*n	*n	*n
*ṇ	*a	*a
*l	*l	*l, *λ
*r	*r	*r
*a, *e, *o	*a, *ə	*a, *ə
*i, *u	*ə	*ə

By way of comparison, it may be noted that Chirikba (2016: 9—11) reconstructs the early Proto-Northwest Caucasian phonological system as follows:

Consonants:

b	p ^h	p'						m	w
d	t ^h	t'	ʒ	c	c'	z	s	n	
			ž	č	č'	ž	š	r	
			Ł	λ	λ'	L	λ	l	
g	k ^h	k'				ĝ	x		j
g	q ^h	q'				γ	χ		
		ʔ				ʕ	H		

Vowels:

i	ü		u
e	ö	ə	o
		a	

Notes:

1. Cf. Colarusso (1989:28) for a slightly different reconstruction of the Proto-Northwest Caucasian phonological system.
2. Cf. Colarusso (2014) for a comprehensive description and analysis of the phonological systems of the various Northwest Caucasian daughter languages.
3. Cf. Colarusso (1992) for a comparison between Proto-Indo-European and Northwest Caucasian.

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